

REMARKS

The applicant thanks the Examiner for the thorough examination of the application. The specification has been amended to correct minor errors. No new matter is believed to be added to the application by this Amendment.

Status of the Claims

Claims 1-21 are pending in the application. Support for the amendments to claim 1 can be found in paragraph 0050 at page 12, line 18 of the specification. Claim 2 has been amended to improve the language. Support for the amendments to claim 12 can be found in Figure 12, in paragraph 0050 at page 12, line 18 and in paragraph 0064 at page 15, lines 14-16 of the specification. Claim 21 finds support in paragraph 0050 at page 12, line 18 of the specification and in claims 1 and 3.

Election/Restriction

The Examiner has withdrawn the restriction requirement and is examining all the claims of the invention.

Rejections Based on Rho

Claims 1, 2, 7, 8 and 11 are rejected under 35 U.S.C. §102(b) as being anticipated by Rho (U.S. Patent 6,057,896). Claims 3, 4, 9 and 13-15 are rejected under 35 U.S.C. §103(a) as being obvious over the combination of Rho in view of Shimada (U.S. Patent 6,424,399). Claims 5, 10, 16 and 17 are rejected under 35 U.S.C. §103(a) as being obvious over the combination of Rho in view of Jeong (U.S. Patent 6,137,551). Claims 6 and 18 are rejected under 35 U.S.C. §103(a) as being obvious over the combination of Rho in view of Shimada (JP-03-141325). Claims 12, 19 and 20 are rejected under 35 U.S.C. §103(a) as being obvious over Rho. Applicant respectfully traverses.

The Present Invention and its Advantages

The present invention pertains to a liquid crystal display having a novel geometry that increases aperture ratio and also increases the capacitance of the storage capacitor. The streamlined geometry of the inventive display permits connection of the pixel electrode to the drain by using a protective layer covering the source electrode, the drain electrode and some portions of the pixel electrode. That is, the pixel electrode can connect to the drain without recourse to a contact hole.

The invention finds a typical embodiment in instant claim 1:

1. (Currently Amended) A liquid crystal display, comprising:
a gate electrode over a substrate;
a gate insulating film entirely deposited over the substrate to cover said gate electrode;
an active layer formed on said gate insulating film which overlaps with said gate electrode;
an ohmic contact layer formed on said active layer;
a source electrode formed on said ohmic contact layer;
a drain electrode formed on said ohmic contact layer, the drain electrode being opposed to said source electrode to form a channel;
a storage electrode formed at a pixel cell area of a same layer as said gate electrode; and
a pixel electrode formed to oppose to said storage electrode having said gate insulating film in between said pixel electrode and said storage electrode, and said pixel electrode being electrically connected with said drain electrode; and
a protective layer covering said source electrode, said drain electrode and some portions of the pixel electrode.

One of the important aspects of the invention also lies in a buffer metal layer being formed on the source and drain electrodes (Claims 3 and 13). This buffer metal layer reduces contact resistance (claims 9 and 14).

Distinctions of the Invention Over Rho and the Secondary References

In summary, the cited art references are conventional art in which the pixel is formed on the protective layer covering the drain electrode and connected with the drain electrode through a contact hole formed by patterning the protective layer. However, in the invention, the pixel electrode is formed on the drain electrode and patterned. Afterwards, the protective layer is covered thereon and

patterned to open many portions of the pixel electrode with some portions overlapping the drain electrode. That is, the pixel area portion of the pixel electrode is opened and some portions of the pixel electrode are covered by the protective layer.

Rho pertains to liquid crystal displays using an organic insulating material for a passivation layer and/or a gate insulating layer. The Examiner turns to Figure 3 of Rho, which is reproduced below:

FIG.3

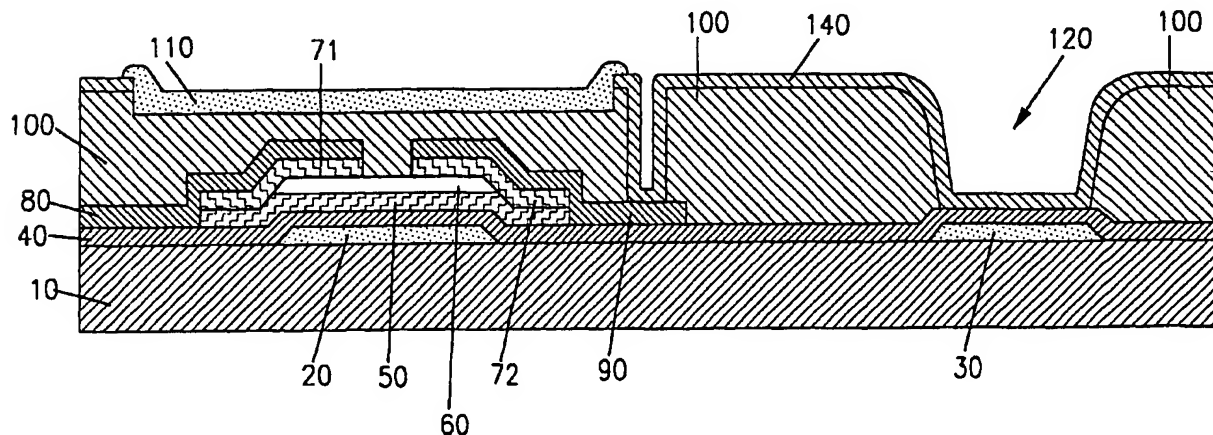


Figure 3 of Rho shows a gate insulating layer 40 on a gate electrode 20. A TFT structure (source electrode 80, drain electrode 90, amorphous silicon layer 50, etch stopper layer 60, and ohmic contact layer 71, 72) is formed over the gate insulating layer 40. Figure 3 of Rho also shows a storage capacitor electrode 30

and a pixel electrode 140. A notable feature of Rho's technology is the passivation layer 100, that necessitates the utilization of a contact hole.

Rho fails to disclose or suggest a technology where the pixel electrode can connect to the drain electrode without recourse to a contact hole.

Rho at column 5, lines 7-8 states: "The passivation layer 100 has a contact hole 130 exposing the drain electrode 90 . . ." In contrast, the invention has "said pixel electrode being electrically connected with said drain electrode without using a contact hole." See claims 1 and 12.

Rho also teaches away from the invention. Rho at column 5, lines 41-47 states:

The storage capacitor electrode 30 and the pixel electrode 140 form a storage capacitor. Because there is thick passivation layer 100 between the two electrodes 30 and 140, the storage capacitance may not be sufficiently large. To compensate for the storage capacitance, the portion of the passivation layer between the two electrodes 30 and 140 may be removed or become thinned.

In contrast, an object of the invention is to increase storage capacity, and this is accomplished by eliminating the thick passivation layer so that the pixel electrode can contact the drain electrode directly, and not through a contact hole. In part, the reduction of contact resistance by the buffer metal layer permits this electrode geometry.

In contrast, Rho merely teaches thinning the passivation layer, and one having ordinary skill would not be motivated by this teaching to have the pixel electrode contact the drain electrode directly, and not through a contact hole.

As a result, Rho clearly fails to anticipate the claimed invention. Rho additionally provides no motivation to one having ordinary skill in the art to produce a high aperture ratio liquid crystal display having high capacitance where the pixel electrode can contact the drain electrode directly, and not through a contact hole.

The Examiner turns to Shimada for teachings pertaining to buffer metal layers of Mo, Ti or Ta. The Examiner turns to Jeong for teachings pertaining to a storage electrode of a transparent conductive material such as ITO. The Examiner turns to Shimada (JP-03-141325) for teachings pertaining to an auxiliary electrode.

However, none of Shimada, Jeong or Shimada (JP-03-141325) addresses the failure of Rho to teach or suggest a liquid crystal display having the pixel electrode that can contact the drain electrode directly, and not through a contact hole, as is set forth in claims 1 and 12. A *prima facie* case of obviousness has thus not been made. Claims depending upon independent claims 1 and 12 are patentable for at least the above reasons.

These rejections are accordingly overcome and withdrawal thereof is respectfully requested.

Prior Art

The prior art cited but not utilized by the Examiner shows the status of the conventional art that the invention supercedes. Additional instructions are accordingly not necessary.

Foreign Priority

The Examiner has acknowledged foreign priority most recently in the Office Action of April 13, 2004.

Drawings

The Examiner is respectfully requested to indicated whether the drawing figures are acceptable in the next official action.

Conclusion

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Robert E. Goozner, Ph.D. (Reg. No. 42,593) at the telephone number of the undersigned

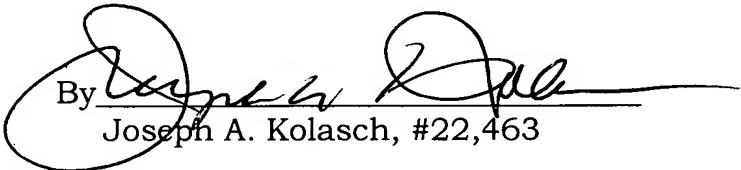
below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

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By


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